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INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

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GAS ABSTRACTS

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1. GAS INDUSTRY

Construction Regulations

Gump, R. A. STATE LAWS AND REGULATIONS AFFECTING PIPE LINE CONTRACTORS. *Petroleum Eng.*, 25, D40, 42-4, 46 (1953) March.

A summary of the more important regulations of the various legislative bodies is presented under the following headings: 1. Labor-management relations; 2. Contractor's licenses; 3. Income taxes; 4. Property taxes; 5. Sales, use and gross-receipt taxes.

R. F. Bukacek

Discriminatory Rates

Falck, E. IMPACT OF FPC RATE REGULATION ON NATURAL GAS PRODUCTION. *Public Utilities Fortn.*, 51, 420-423 (1953) March 26.

While the cost of living in 1951 had increased 85.6% over the 1935-39 average, coal prices were up 104-114%, and oil prices were increased 81-91%, natural gas prices showed a decrease of 15-18%. FPC regulation of rates charged by pipeline companies for gas produced on their own properties are slowly driving pipeline companies out of the field of production; all major transmission companies going into production since 1942 depend entirely upon gas purchase contracts for their supply, finding it uneconomical to explore and develop reserves themselves.

A. E. Neumann

Fuel Consumption

Coumbe, A. T. and Avery, I. F. RESIDENTIAL AND COMMERCIAL FUEL CONSUMPTION INCREASED 55 PER CENT IN YEARS 1935-51. *Gas Age*, 111, 37-39 (1953) March 26: U.S. Bur. Mines Inform. Circ. 7657 (1953) January.

Compilation of statistics gives breakdown of total energy use for all mineral fuels, hydroelectric generation, and wood. Grand totals rise from 61,660 to 95,586 million therms, with natural gas supplying 19,759 showing 500 per cent increase. Authors' Abstract

Industrial Gas Load

PETROLEUM ADMINISTRATION FOR DEFENSE SEES 71 PER CENT INCREASE IN INDUSTRIAL GAS USE. *Ind. Gas*, 31, 11-3 (1953) March.

Excerpts from the recent PAD report show estimates of the character of the future gas load. R. F. Bukacek

Leadership

Diehl, D. L. AREA DEVELOPMENT PROGRAM FOR UTILITIES. *Public Utilities Fortn.*, 51, 286-293 (1953) February 26.

Pennsylvania Power and Light Company's program for developing its business area includes work with both existing and prospective industries in such diversified fields as product improvement and sales, plant location, the labor market, raw materials and taxation. It is felt that such activity benefits the utility directly in that its economic wellbeing depends upon the economic health of its market. Further, this program is quite effective in building good public relations. It is proposed that the public utility alone among group interests in area development has the perspective, leadership, organization, prominence and diversity to carry out the sustained program necessary to produce results. R. E. Bukacek

2. APPLIANCES

Burners

Wyatt, D. W. GAS BURNER AND INTERNAL BAFFLE FOR GAS DISTRIBUTION. U. S. 2,626,656 (1953) January 27.

Westling, C. J. (assigned to H. A. Brassert & Co.) CONCENTRIC GAS AND AIR BURNER. U. S. 2,627,307 (1953) February 3.

Palmer, O. C. and Schmoll, W. J. (assigned to Palmer Manufacturing Corp.) GAS BURNER AND PORT-FORMING GRID. U.S. 2,628,675 (1953) February 17.

Kuhn, W. J. (assigned to Heatbath Appliances, Inc.) GAS BURNER AND SUPPORTING PLATE. U. S. 2,630,859 (1953) March 10.

Wright, J. A. (assigned to Missouri Automatic Control Corp.) BURNER ORIFICE SPUD. U. S. 2,631,659 (1953) March 17.

Burner Controls

Wilson, J. M. (assigned to Minneapolis-Honeywell Regulator Co.) BURNER CONTROL APPARATUS WITH COMPONENT CHECKING MEANS. U. S. 2,626,657 (1953) January 27.

McDowell, H. TIME CONTROLLED FUEL FEED MECHANISM FOR GAS BURNERS. U. S. 2,626,661 (1953) January 27.

Shottenfeld, R. (assigned to Ensign Ribbon Burners, Inc.) SPARK RESPONSIVE SAFETY CONTROL SYSTEM FOR GAS BURNERS. U. S. 2,628,676 (1953) February 17.

Strobel, C. K. (assigned to Robertshaw-Fulton Controls Co.) SAFETY CONTROL AND IGNITION APPARATUS FOR GASEOUS FUEL BURNERS. U.S. 2,628,677 (1953) February 17.

Cerney, J. A. and Green, N. B. (assigned to Affiliated Gas Equipment, Inc.) BURNER CONTROL MEANS. U. S. 2,630,860 (1953) March 10.

Water Heater

Rostek, V. R. COMBINATION GAS AND ELECTRIC HOT-WATER HEATER WITH HEAT ABSORBER-TRANSMITTER IN THE FLUE. U. S. 2,628,597 (1953) February 17.

3. COMBUSTION AND INDUSTRIAL FURNACES

Air Pollution

McCabe, L. C. ATMOSPHERIC POLLUTION. *Ind. Eng. Chem.*, 45, 112A-14A (1953) January.

Publications in this field during 1952 are briefly described. The organization and scope of the ACS Committee on air pollution is discussed.

C. E. Hummel

McCabe, L. C. ATMOSPHERIC POLLUTION: CATALYTIC COMBUSTION OF ODOR-PRODUCING AGENTS. *Ind. Eng. Chem.*, 45, 109A, 110, 112A (1953) March.

Paint-solvent vapors are oxidized by air in Houdry catalyst units employing active material containing a platinum alloy and alumina. Recovery of heat from the stack gas has effected more economical operation of the unit. Noxious plant odors due to organic vapors have been destroyed by these highly efficient units.

C. E. Hummel

Blast Furnace Operation

Ergun, S. PRESSURE DROP IN BLAST FURNACE AND IN CUPOLA. *Ind. Eng.* Chem., 45, 477-485 (1953) February.

A pressure drop equation, developed earlier from fundamental theories of fluid flow in packed columns, is applied to blast furnaces. Experimental data of Kinney are studied, to show the effect of several operating variables. Present practise in blast furnace operation probably gives excessive channeling, which reduces the heat transfer and reaction rates. Proper sizing (close size ranges) to increase the fractional void volume might increase present production rate by 300%.

O. P. Brysch

Chimney Design

Mingle, J. G. PROPERLY-SIZED CHIMNEYS AID SMOKE CONTROL. *Power Eng.*, 57, 82, 83, 119 (1953) March.

This article shows how chimney performance depends on some 14 factors.

W. J. Pleticka

Forging Furnace

Dale, D. R. NEW GAS-FIRED FURNACES SPEED SUCKER ROD PRODUCTION. *Gas*, 29, 42-3 (1953) March.

A high-speed slot forge furnace is described, which was designed by the Surface Combustion Corp. and installed at the S. M. Jones Co., Toledo. Essentially the furnace incorporates a split side-wall heating chamber with gas-fired line burners firing vertically downward into a refractory-bed hearth. Elimination of conven-

tional side walls and burners enables straight-through travel of stock and yet relatively high fuel efficiencies. High heat releases, complete combustion and a minimum of decarburization are achieved by nearness of incandescent refractory bed and high velocities of burning gases in narrow confines of the furnace.

R. A. Bambenek

Hay Drying

Baker, V. H. and Earp, U. F. DESIGN OF HAY DRYING SYSTEMS. PART I *Heating Ventilating*, **50**, 77-81 (1953) March.

Equipment and structural requirements for design of hay drying systems are discussed. Location of the dryer, the use of heated air instead forced natural air and various air distribution systems are considered.

P. P. Leo

Heating Costs

Richards, R. B. GAS SAVES PLANT 17% ON HEATING COSTS. *Gas*, **29**, 44-5 (1953) February.

An installation in Kings County, Brooklyn, is described in which 49% of the estimated cost of a new plant heating system and 17% of the operating cost of the system were saved by using gas instead of oil or fuel.

E. F. Searight

Heat Treating

Munford, T. W. (assigned to Surface Combustion Corp.) COMBINATION HEAT-TREATING FURNACE AND GAS GENERATOR. U. S. 2,630,315 (1953) March 3.

A novel controlled gas atmosphere heat treating furnace is claimed. The furnace contains a heated catalyst and means for supplying the gas for heat treatment. The gas atmosphere generator and heat treating chamber are in intimate heat-exchange relation the hot gas being circulated by a fan to the work being treated.

G. Engholm

Inert Atmosphere

Hotchkiss, A. G. (assigned to General Electric Co.) APPARATUS AND METHOD FOR PRODUCING A GAS ATMOSPHERE. U. S. 2,631,135 (1953) March 10.

An apparatus and method for producing an inert gas atmosphere by combustion of a fuel gas is described. Novel means of using the heat of combustion to regenerate the liquid absorption medium used for purification of the gas from CO_2, H_2S, and SO_2 are claimed.

D. M. Mason

Radiant Heating

Lockwood, F. W. and Davies, D. J. HIGH TEMPERATURE RADIANT HEATING IN INDUSTRY.—I. *Gas World* (British) **87**, Suppl. 6-9 (1953) January 17.

Different basic designs of high temperature radiant heat equipment are described in the first section of this paper. Emphasis is laid on basic principles and materials of construction.

A. R. Khan

Lockwood, F. W. and Davies, D. J. HIGH TEMPERATURE RADIANT HEATING IN INDUSTRY—II. *Gas World* (British) **87** Suppl. 28-30, 32 (1953) February 21; *Gas J.* (British) **273**, 332, 37, 38, 42 (1953) February 11.

The second part discusses considerations required by radiant heating applications such as output, operation, critical temperatures, etc., and descriptions of actual installations are given.

A. R. Khan

Slag Reduction

McIlroy, J. B., Holler, E. J. and Lee, R. B. SUPERHEATER SLAG BOWS TO ADDITIVES. *Power*, **97**, 86-8, 212, 4 (1953) March.

Mixing certain additives with fuel oil before combustion produces a slag that can be removed by air lancing. Alumina and dolomite are the most suitable additions from the standpoint of economy and availability when mixed on a 1 to 1 ratio with the ash content of the oil. With addition, a dry powdery, easily removable deposit, with a high fusing temperature is formed. Both alumina and dolomite have been used on a commercial scale with favorable results. Corrosion and erosion effects of the additives have not been fully investigated.

E. J. Pyrcioch

4. CARBONIZATION AND GASIFICATION

Anthracite Future

Kaufman, A. FUTURE OF THE PENNSYLVANIA ANTHRACITE INDUSTRY. *Mining Eng.*, 5, (ASME Trans.) 286-8 (1953) March.

Increased mine mechanization, cheaper disposal of seepage water, and improved realization from fine-sized products must be achieved by the Pennsylvania anthracite industry if its position is to be improved. Some progress is being made, but its sale as fuel must be continued to finance the research needed to prove anthracite's real value in non-fuel uses, such as in the metallurgical, carbon disulfide and synthesis-gas chemical fields. O. P. Brysch

Coal Ash Metals

Headlee, A. J. and Hunter, R. G. ELEMENTS IN COAL ASH AND THEIR INDUSTRIAL SIGNIFICANCE. *Ind. Eng. Chem.*, 45, 548-51 (1953) March.

The coal mined annually in West Va. yields about 10 million tons of ash. The industrial significance of the 38 elements found in this coal ash may be estimated from results of 596 samples from 16 seams in the major coal producing areas, analyzed by the Littrow spectrograph. Li Rb, Sr, Ba and Mg compounds might be recovered from coal ash, these elements averaging 0.27, 0.30, 0.54, 0.31 and 0.99% respectively. Germanium (Ge) averaging 0.013%, occurs in organic matter of coal, and is concentrated in the bottom and top inches of the coal seams. Gravity separation of the bottom 3 inches gives coal with ash of 0.3% Ge_2O_3, and of $57.50/ton ore-value. Surprising concentrations of these and 11 other elements occur in local lenses. Wide variability of many elements in the seam and in the mining area indicate that average values of ash fusion temperatures will be poor indexes of clinker formation, and that catalytic gasification and hydrogenation of coal may be greatly effected. These analyses also afford an estimate of nutrient elements needed for maximum plant growth.
O. P. Brysch

Steward, K. GERMANIUM IN COAL ASH. *Gas World* (British), 87, 794-795 (1953) March 21; *Gas J.* (British) 274, 279-80 (1953) April 29.

Boiler-flue dusts and producer dusts in Britain, which contain 0.2 to 0.9% germanium, could made to yield 2000 tons of germanium per year. The importance of germanium in the radio field, and the desirability of replacing imports from the U.S.A. are the chief reasons for investigating its extraction from flue dusts. Gravimetric, volumetric and absorptiometric methods for the determination of germanium in flue dusts are described. D J. Dennison

Coke Oven Operations

Trefny, F. GENERAL HINTS ON RAISING THE ECONOMY IN THE OPERATION OF COKE OVENS (ALLGEMEINE HINWEISE ZUR ERHOEHUNG DER WIRTSCHAFTLICHKEIT BEIM BETRIEB VON KOKSOEFEN.) *Brennstoff-Chemie* 34, 45-51 (1953) February 18.

Improved economy, as shown in the monthly plant financial results, can be achieved by attention to the factors included under (1) increased coal throughput (2) increased yields (3) increased value (4) reduced expenses. The effects of operating factors such as coal selection, oven design and operation upon each of these surveys are discussed in detail, supported by 70 references. O. P. Brysch

Cracking Catalysts

Shapleigh, J. H. (Assigned to Hercules Powder Co.) PROCESS FOR THE DECOMPOSITION OF HYDROCARBONS. U.S. 2,628,890 (1953) February 17.

It is claimed that hydrocarbon containing at least 1 gr. of S/100 cu. ft. can be catalytically cracked over a nickel catalyst with results comparable to those obtained with substantially sulfur-free feed stocks by increasing the reaction temperature to at least 900° C. or approximately 125° C. over the temperature normally used. The length of time the high conversion can be maintained is not given.
H. A. Dirksen

Gasification

Allan, G. W. DEVELOPMENTS IN THE TOTAL GASIFICATION OF COAL. *Brit. Coal Utilisation Research Assoc. Bull.* **16**, 477-486 (1952) November.

Total gasification as it exists today in the United States, Germany and Great Britain is described briefly in this survey. This problem is more critical in Germany and Great Britain where the coking coal deposits have been decreasing very rapidly, but where still remains a great reserve of high ash and high volatile coal. S. Mori

King, J. G. GASIFICATION OF PULVERISED COAL. *Coke and Gas* (British), **15**, 57-60 (1953) February.

A new commercial-scale pulverized coal gasifier has been installed in Finland by Koppers-Totzek, capable of gasifying 50 tons of coal/d in their three generators. No operational data are available, however a 90% carbon conversion is anticipated from data obtained in the Bureau of Mines pilot plant for an oxygen requirement of 0.32 cu.m/cu. m. of gas and a product composition of 80 to 90% CO plus H_2.

S. Mori

Gasification Reactions

Hunt, B. E., Mori, S., Katz, S. and Peck, R. E. REACTION OF CARBON WITH STEAM AT ELEVATED TEMPERATURES. *Ind. Eng. Chem.*, **45**, 65 (1953) March.

This paper describes part of a study of the reaction of carbon with steam initiated under the sponsorship of the American Gas Association to add to our knowledge of the fundamentals of industrial manufactured gas processes. The present discussion is concerned principally with methods of treatment of the data obtained in a high temperature reacting system. The reaction was studied by passing steam at various flow rates through a fixed carbon bed and examining the reaction products. The temperature range lay between 1800° and 2500° F. In the temperature range between 1800° and 2100° F., an activation energy of at least 45 kcal. was obtained. Above 2100° F. the energy of activation dropped rapidly to zero. The experimental data were used to examine a hypothesis which proposed that the reaction rate was controlled both by surface and diffusional reaction mechanisms. The data corroborated the hypothesis, suggesting that either a sorption or surface chemical reaction controls the rate below 2100° F., while at higher temperatures the reaction rate is controlled by mass transfer. The values of the energies of activation are consistent with these conclusions. The occurrence of the temperature of transition at this comparatively low value may be expected to have useful applications in the field of industrial gasification. Authors' Abstract

Gas from Wood

Peters, W. INFLAMMABLE GAS PRODUCING APPARATUS. U. S. 2,631,930 (1953) March 17.

An apparatus for producing an inflammable gas by carbonizing sawdust is described.

E. J. Pyrcioch

Hydrocarbon Gasification

Morgan, J. J. GASIFICATION OF HYDROCARBONS FOR PRODUCTION OF GASES TO SUPPLEMENT NATURAL GAS IN CITY SUPPLIES. CHAPTER X. LIQUEFIED PETROLEUM GASES (Part 3). *Gas Age*, **3**, 42-44 (1953) February 26.

Recent practice in making natural gas substitutes from LP-gases for peak-shaving is reviewed. Equipment, storage, costs, engineering practice and personnel training are discussed.

O. P. Brysch

Inert Gas Generators

Zimmerman, O. T. and Lavine, I. INERT GAS GENERATORS. *Chem. Eng. Costs Quarterly*, 3, 18-30 (1953) January.

Kemp inert gas generators available with auxiliary equipment for spray cooling, sulfur and carbon dioxide removal for the production of nitrogen for purging and other uses, are estimated to cost $3,400 to $15,200 in a range of capacities from 1000 to 20,000 SCF/hr inert gas. C. von Fredersdorff

Lignite Gasification

Burr, A. C., Holtz, J. C., Koth, A. W. and Oppelt, W. H. GASIFICATION OF LIGNITE IN A COMMERCIAL-SCALE PILOT PLANT. *U. S. Bur. Mines* Rept. Invest. 4940 (1953) February.

Results of operations are reported on the commercial-scale pilot plant at Grand Forks, N. Dak., for the gasification of lignite. Hazen mine, Mercer County, lignite was used, of 36.2% moisture, 27% volatile matter, 30.1% fixed carbon, and 6.4% ash content. Gasification took place in the 3-inch annular space between 48-inch and 42-inch diameter alloy tubes, with the larger tube heated by a surrounding combustion space. The 20-foot column of descending lignite was carbonized, and gasified by steam injected at the base or at the 7-foot level, or both. Yields of 36 to 54 MCF/ton natural lignite, at rates of 6 to 12 MCF/hr were obtained, of 246 to 293 Btu gas with an H/CO ratio varying between 2.3 and 9.0. Chars of 25 to 47% ash content were recovered. The report covers runs of 1996 hours with several types of alloy tubes. Detailed data are appended. O. P. Brysch

Lurgi Plant

Bruggemann, E. A. LURGI PRESSURE GASIFICATION PROCESS. *Gas Times*, 74, 170-175, 178 (1953) February 6.

An economic and technological analysis on the Lurgi pressure gasification process is presented, considering the utilization of non-coking coals. A 5,000 million cu. ft./annum plant to gasify low-grade Gippsland brown coal with steam and oxygen at approximately 400 psig is under construction in Melbourne, Australia. This plant will provide 420-470 Btu town gas over a 100-mile radius or it will, in conjunction with a synthesis plant, supply high Btu gas and liquid fuels which are in increasing demand in this area. Such a synthesis gas plant, of 40,000 CF/year capacity, is under construction in South Africa. J. M. Reid

Paraffin Pyrolysis

Hepp, H. J. and Freu, F. E. PYROLYSIS OF PROPANE AND BUTANES AT ELEVATED PRESSURE. *Ind. Eng. Chem.*, 45, 410-415 (1953) February.

A laboratory study of the pyrolysis of propane and butanes was made at pressures up to 170 atmospheres and at temperatures between 900 to 1200° F. Product distributions, as compared to atmospheric pyrolysis, for the butanes showed less olefins. Practical per-pass destruction of n-butane was limited to 50% and pentane per-pass destruction was limited to 30%. The reactions proceed at substantially higher rates under pressures. G. V. Vosseller

S-Reducing Bacteria

Hare, N. TRACES OF HYDROGEN SULPHIDE DUE TO LIVING ORGANISMS IN PURIFIERS. *Gas Times*, 74, 147, 8, 53 (1953) February 6; *Gas J.* (British) 274, 148-50 (1953) April 15.

Plant tests and laboratory examinations indicated that living organisms in new oxide were responsible for the presence of hydrogen sulfide in gas passed through the purifying material. This phenomenon is explained, and means for its prevention are discussed.

C. E. Hummel

Supply Pressures

Shaeffer, D. W. and Cowell, F. A. (assigned to Phillips Petroleum Co.) GAS DISTRIBUTION SYSTEM PRESSURE CONTROL. U.S. 2,631,931 (1953) March 17.

An apparatus for maintaining pressure in city gas mains is described. A time clock is employed to increase the pressure from 5 in. to 7 in. of water during peak-load periods.

G. Engholm

Water Pollution

Murdock, H. R. INDUSTRIAL WASTES. *Ind. Eng. Chem.*, 45, 101A-3A (1953) February.

Abatement of acid-water pollution of steams from thousands of abandoned and operating coal mines is a serious problem in Pennsylvania. Neutralization treatment and mine sealing are impracticable. Recent work at strip mines shows that protection of the sulfur-bearing wastes from flowing water, during mining or back-filling, will reduce acid formation.

O. P. Brysch

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Carbon Black

Hahn, H. H. and Hendricks, W. F. (assigned to Godfrey L. Cabot, Inc.) APPARATUS FOR PRODUCING IMPINGEMENT CARBON BLACK. U. S. 2,628,891 (1953) February 17.

This patent relates to an apparatus which serves to reduce and control the air flow to the burners of a channel-black burner-shed, thereby increasing carbon black yield by an average of 6½%. D. V. Kniebes

Compression

Farrar, L. D. A BUMPER CROP OF GAS COMPRESSOR STATIONS. *Public Utilities Fortn.*, 51, 275-85 (1953) February 26.

This is a descriptive article on the function of compressor stations for the distribution of natural gas. D. C. Gami

Dehydration

Campbell, J. M. and Laurence, L. L. DEHYDRATION OF NATURAL GAS AND LIGHT HYDROCARBON LIQUIDS. PART V. TAKING ADVANTAGE OF HYDRATE INHIBITORS WITH EXPANSION REFRIGERATION. *Petroleum Refiner*, 32, 131-4 (1953) February.

Process variables, equipment, and cost of processes using mechanical refrigeration with hydrate inhibitors such as methanol and ethylene glycol are discussed. The direct operating cost is somewhat higher than for other low-temperature systems, but advantages of greater condensate recovery, additional dehydration, and absence of problems from hydrates generally give glycol injection the lowest net cost of any type of dehydrator. D. M. Mason

Harrison, E. R. INTENSE DRYING OF GASES WITH POTASSIUM METAL. *J. Sci. Instruments* (British), 30, 38, 9 (1953) February.

Gases which will not react with potassium at 20-350° C. are dried by passing them through potassium vapor in a simple and readily constructed piece of apparatus. By means of a comparative method involving the formation of ice crystals in a liquid nitrogen bath, the water vapor content of the dried gas is estimated to be one part in 4×10^7 by volume. Other impurities are also removed, such as oxygen, but no tests have been made to determine the degree of purification other than for water vapor. D. J. Dennison

Koepke, B. F. and Stowe, V. M. WITH PROPER CARE, YOU CAN USE DESICCANTS YEARS LONGER. *Gas*, 29, 100-102 (1953) March.

Methods of increasing the service life of solid desiccants (alumina) when used for drying gaseous hydrocarbons such as natural gas are discussed. Removal of contaminants (distillates, brines and dust), proper reactivation techniques, and freedom from mechanical vibration are considered necessary in prolonging desiccant life. J. M. Reid

Desulfurization

Miller, E. B. (assigned to Jefferson Lake Sulphur Co.) METHOD FOR THE RECOVERY OF ELEMENTAL SULFUR IN LIQUID FORM FROM GASES CONTAINING HYDROGEN SULFIDE AND THE CONVERSION OF THE LIQUID SULFUR INTO SOLIDIFIED FLAKES. U. S. 2,630,374 (1953) March 3.

A process and equipment for removal and recovery of H_2S from gas as elemental sulfur is described which is similar to the process of U. S. 2,630,375, except that the flow of gas and regenerating medium are periodically shifted from one catalyst zone to another rather than shifting the catalyst beds. Equipment for efficient disposal of catalyst and equipment for conversion of liquid sulfur into solidified flakes are described. D. M. Mason

Miller, E. B. (assigned to Jefferson Lake Sulphur Co.) METHOD OF CATALYTIC DESULFURIZATION OF GASES. U. S. 2,630,375 (1953) March 3.

A process and equipment for removal and recovery of H_2S from gas as elemental sulfur is described. The process comprises heating the sour gas to a temperature not above 830° F.

and preferably between 375 and 600° F., mixing with SO_2, passing the gas over a catalyst, washing the gas with molten sulfur to extract sulfur vapor formed by reaction of SO_2 and H_2S, reheating the gas, adding additional SO_2, passing the gas over a catalyst in a second converter, and washing the gas again. Two stages of conversion are used in each converter, with intermediate cooling of the gas between stages to remove the heat of reaction and maintain the optimum temperature. The catalyst converters are of a rotary type with the catalyst disposed in multiple tubular reactors which are disposed around and attached to a slowly rotating shaft which progressively moves each reactor from the second reaction stage to the first reaction stage to a regenerative stage and again to the second reaction stage. The catalyst may contain oxides of copper, nickel, manganese, but preferably iron, as the active material. It is used in granular form, supported on a carrier such as silica gel. D. M. Mason

Swaminathan, V. S. THE AUTOFINER AT LLANDARCY. *Petroleum Eng.*, 25, C-21 (1953) March.

A 3500 bbl./day catalytic desulfurization unit, in which a range of distillate oils from gasoline blending stocks to diesel fuels can be treated, was recently installed at the National Oil Refineries in Llandarcy. Sulfur compounds are converted to hydrogen sulfide at temperatures from 750 to 800° F. and at a pressure of 100 psi; enough hydrogen is generated so that with recycling no outside source is required.
D. M. Mason

Distribution Problems

Atkin, F. L. GAS DISTRIBUTION AND CONSUMER SERVICE. *Gas World* (British) 87, 573-5 (1953) February 28.
A number of aspects of distribution are discussed including unaccounted for gas, errors in metering, and costs of new developments.
R. F. Bukacek

Pratt, R. MAINS EXTENSIONS IN RELATION TO HOUSING DEVELOPMENT. *Gas World* (British), 87, 458-62 (1953) Feb. 14.

Discussion and calculations on the problem of designing main extensions. A number of alternative methods of computation are given for feeder mains and dead-end distributors.
R. F. Bukacek

Lester, C. B. MICROWAVES FOR PIPELINERS. PART IV: ANTENNAE AND TOWERS. *Pipe Line News*, 25, 33, 4, 6-41 (1953) February.

This article contains the discussion of microwave systems. The selection of antennae, antenna feeds and towers with a view towards achieving a working balance between system performance and cost is described.
R. A. Brown

Procopi, J. and Drake, W. W. GAS TRANSMISSION CONTROL PROBLEMS. *Petroleum Eng.*, 25, D3-D6, D8 (1953) March.

New methods of instrumentation employed by transmission companies are described and how their use is resulting in greater accuracy and dependability in natural gas dehydration and compression. A packaged absorption type dehydration unit is described with the latest type contollers for cycle time and temperature regulation. Solution of compression problems such as gas pressure measurements, cooling water temperature and water treatment by automatic controllers are discussed also. A brief description of microwaves is given and how their role in telemetering has been made possible through instrumentation, in a typical system.
R. A. Bambenek

Drilling Forecast

Baker, W. L. and Smith, C. W. DRILLING FORECAST IS FOR 46,988 NEW WELLS. *World Oil*, 136, 129-130 (1953) February 15.

Total wells for 1953 are expected to exceed 1952 drilling by 1103, with an increase of 4 million ft. of hole. This represents a 2.3% increase over 1952. B. E. Eakin

Earthquake vs. Wells

Rintoul, W. T. EARTHQUAKE DAMAGE IN KERN COUNTY. *Petroleum Eng.*, 25, A74, 76, 80 (1953) February.

The earthquakes in July and August resulted in the total loss of only 4 wells and a 1500 bbl.

storage tank. Pipe in some wells was severely bent and twisted. Surface installation were slightly damaged. Gas pressure increased after the quake in many old wells and fluid output dropped. Within a few days, pressure began to drop and fluid output returned to normal. 75 wells in the Kern River field sanded up and had to be cleaned before returned to production. 96 wells handled by the Paloma cycling plant were shut-in, after a gas line ruptured by the quake ignited the plant resulting in $1,500,000 damage. The quake did not seem to affect oil and gas potential production.

B. E. Eakin

1952 Gas Production

NATURAL GAS: PRODUCTION, VALUE INCREASE. *World Oil*, 136, 194-6, 9 (1953) February 15.

The 1952 natural gas production was 10% higher than 1951, and the average sale value increased from 29.8 to 31.0¢ per MCF. The estimated proved reserves at the end of 1952 were sufficient for 22.9 years at the 1952 rate of production. Tables of reserves, production and value and marketed production by states from 1906 thru 1952 are included.

B. E. Eakin

Production

Carlson, R. F. NEW TECHNIQUE PROVED: HIGH-PRESSURE GAS INJECTION. *Oil Gas J.*, 51, 70 (1953) March 9.

The mechanism of high-pressure gas injection when operated in the miscible or immiscible range, and the effect on percent recovery of total reservoir fluid, is discussed.

B. E. Eakin

Dill, G. A. (assigned to John C. Kinley) PIPE SEVERING METHOD AND APPARATUS. U. S. 2,629,445 (1953) February 24.

A pipe severing mechanism utilizes a local high-energy heat source such as thermite to weaken the pipe walls and allow the pipe to be pulled apart. Also a joint connecting mechanism locates the point at which the pipe is stuck in a hole.

B. E. Eakin

Huber, T. A. and Tausch, G. H. PERMANENT-TYPE WELL COMPLETION. *J. Petroleum Techn.*, 5, 11-16 (Trans.), (1953) January.

Procedures for the completion, work-over and recompletion involving squeeze cementing, perforating, and artificial lift by thru-the-tubing operation have been developed and field tested. By this method costs of original completion and work-over remedial work have been materially reduced.

B. E. Eakin

Spraberry Shut In

SPRABERRY SHUT IN. *Oil Gas J.*, 51, 57-58 (1953) March 30.

The Texas Railroad Commission has ordered the producing wells in the high Spraberry trend of West Texas shut in, effective April 1, until flaring of natural gas is halted. Gas production is estimated at 280 MMCF/D. Gas processing facilities to handle the gas are expected by the first of next year.

H. A. Dirksen

Sulfur Recovery

Thornton, D. P., Jr. SULFUR VIA THE BELT LINE. *Petroleum Processing*, 8, 389-391 (1953) March.

A 120-ton/day sulfur recovery plant at the Poza Rica refinery of Petroleos Mexicanos is described. The process is conventional, utilizing hydrogen sulfide from sour natural gas and crude stabilizing operations, by the monoethonolamine and catalytic Claus route. A novel method of producing flake sulfur by means of a stainless steel conveyor belt is described.

D. M. Mason

Underground LP-G Storage

Kornfeld, J. A. CALIFORNIA STANDARD SUCCESSFULLY STORES L.P.G. IN WATER-FILLED SANDSTONE. *Oil Gas J.*, 51, 109-110 (1953) March 9.

Standard Oil Co. of California has successfully stored 2,520,000 gal. of propane gas without any contamination in an underground water-filled sandstone reservoir at the depth of 3400 ft.

I. P. Patel

Serif, M. and Rafferty, J. C. UNDERGROUND STORAGE — A STEP FORWARD. *LP-Gas*, 13, 132-135 (1953) February.

The increasing use of underground storage for LP-gases is discussed with reference to the type of areas suitable to subsurface storage and the methods used. R. Bukacek

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Bogart, M. J. WULFF PROCESS FOR ACETYLENE. p. 92

Buchanan, A. C., Jr. ELECTRONICS SPEEDS GAS CALCULATIONS. p. 94

Gump, R. A. STATE LAWS AFFECTING CONTRACTORS. p. 77

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Adsorption Process

Eagle, S., and Scott, J. W., Jr. (assigned to California Research Corp.) REGENERATION OF SOLID ADSORBENTS. U. S. 2,628,933 (1953) February 17.

This patent covers the cyclical regeneration of solid adsorbents when used as a guard zone and adsorption zone in separation by selective adsorption. This applies to adsorption separation of kerosene, naphtha, or petroleum distillate. B. E. Eakin

Cracking

Ruschmann, W. CRACKING DES HYDROCARBURES DANS LES FOURS A COKE (CRACKING OF HYDROCARBONS IN COKE OVENS). *Rev. Gen. Gaz.* (Belgian), 75, 26-7 (1953) January-February; *Glueckauf* 88 (1952), Heft 15/16.

A condensed version of the earlier German article is given. Cracking of residual Aramco oils and of aromatic tar oils is discussed. Experimental oven tests, using oil-coal mixtures (up to 20% oil) and also with oils injected within the charge are reviewed. Catalytic effects of the metallic constituents of the coal ash, and of added materials such as Al_2O_3, are beneficial in increasing aromatic and olefine yields. Yields per ton oil are: 975 m^3gas, 100 kg benzol, 56,7 kg ethylene, 25 kg gasoil (propane-propylene) 250 kg tar and 250 kg coke. O. P. Brysch

Fischer-Tropsch Synthesis

Anderson, R. B. and Shultz, J. F. (assigned to United States of America) IRON NITRIDE CATALYSTS IN CARBON OXIDE HYDROGENATIONS. U.S. 2,629,728 (1953) February 24.

A process of reacting carbon monoxide and hydrogen by means of an iron nitride catalyst is claimed. W. J. Pleticka

Weitkamp, A. W. and Frye, C. G. RELATION OF PRODUCT COMPOSITION TO REACTION MECHANISM. *Ind. Eng. Chem.*, 45, 363-67 (1953) February.

A study of the reaction mechanisms of the hydrogenation of carbon monoxide is presented. None of the proposed reaction mechanisms fully fit the experimental data. Although it appears that olefins and aldehydes are the primary products, it is not possible to exclude paraffins from the primary products. The data presented are useful for the evaluation of proposed mechanisms. G. V. Vosseller

Fischer-Tropsch Products

Cain, D. G., Weitkamp, A. W. and Bowman, N. J. OIL-SOLUBLE OXYGENATED COMPOUNDS. *Ind. Eng. Chem.*, 359-362 (1953) February.

Oxygenated compounds produced by the reaction of hydrogen and carbon monoxide over iron catalyst have been separated from the water and oil streams of the synthesis process and their identification by class and quantity presented in tabular and graphical form. Seven acids and thirty-two nonacid compounds consisting principally of straight chain alcohols, aldehydes and ketones have been found in the water stream. The oxygenated compounds identified in the oil stream are higher homologs of those found in the water stream. Branched chain compounds, esters, and cyclic ketones are present in minor proportions in both streams. J. M. Reid

Gas Pressure Reactor

Kuentzel, W. E. and Field, E. (assigned to Standard Oil Co.) HIGH-PRESSURE CONTACTING APPARATUS. U. S. 2,631,091 (1953) March 10.

An improved laboratory scale high-pressure reactor embodying precision stirring and recycle of the gaseous phase is described. Stirring is accomplished by a totally enclosed magnetically operated plunger, while gas recycle is accomplished by means of a plate check valve attached to the plunger and an internal conduit connecting the top and bottom of the reactor.

J. M. Reid

Production

Miller, J. C. GEOLOGIC AND ENGINEERING ASPECTS OF CONTINENTAL SHELVES. *Oil Gas J.*, **51**, 78-82 (1953) March 2.

Interesting speculation is given on ways and means of realizing additional production from the world's continental shelf areas, if and when this potentially enormous reserve is more actively exploited. B. E. Eakin

Peters, C. M. (assigned to Garrett Oil Tools, Inc.) GAS LIFT APPARATUS. U. S. 2,629,-335 (1953) February 24.

A novel valve design for producing by gas lift, permitting the well to be produced either thru the tubing or the casing-tubing annulus.

B. E. Eakin

Synthetic Fuel Costs

Linz, B. F. SYNTHETICS STILL COSTLY. *Oil Gas J.*, **51**, 42-43 (1953) March 2.

A summary of synthetic liquid-fuels production costs is given as compiled by the industry committee of the National Petroleum Council. The committee analyses showed that gasoline manufactured from oil shale would cost 14.7 cents/gal at the refinery, while gasoline made from coal by the Fischer-Tropsch process would cost 29.4 cents and that from hydrogenation processes "at least" 36.3 cents.

H. A. Dirksen

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Gomer, R. FIELD EMISSION FROM NICKEL. p. 91

Rintoul, W. T. EARTHQUAKE DAMAGE IN KERN COUNTY. p. 84

7. ANALYTICAL METHODS AND TESTS

Acid Sludge Analysis

Weiss, F. T., Jungnickel, J. L., Peters, E. D. and Heath, F. W. ANALYSIS OF SULFURIC ACID AND ACID SLUDGES FROM PETROLEUM PROCESSES. *Anal. Chem.*, 25, 277-284 (1953) February.

The sulfuric acid consumed in a number of refinery processes can be more economically utilized when analytical methods are available for the determination of the components of the acid and sludge streams. Analytical methods have been evaluated for determination of the principal components of the "spent acid" streams from treatment of lubricating oils with sulfuric acid and from preparation of gasoline alkylate and alkyl benzene. The determinations which can be made include: total acidity, titratable acidity, ester (by difference), free sulfuric acid, sulfur dioxide, water, neutral oil and sulfonic acid content, and equivalent weight of the sulfonic acids. Authors' Abstract

Analytical Review

Levin, H. PETROLEUM. *Anal. Chem.*, 25, 47-54 (1953) January.

The annual review (biennial in the future) of analytical developments in the field of petroleum technology includes sections on crude oil, gas, gasoline, kerosene and heavier fuels, lubricating oil, asphalt, specialties, pollution, sulfur and its compounds, catalysts, and miscellaneous. The adaptions of instrumental methods to the solution of various problems continues to be a major trend. D. M. Mason

Gas Analysis

Guild, L. V. APPARATUS FOR MAKING GAS ANALYSES. U. S. 2,631,088 (1953) March 10.

This apparatus for approximate determination of a gaseous compound consists of a ring-

shaped piston moving by gravity in the annular space between two concentric cylinders. By tilting the apparatus, a gas sample charged into this annular space can be forced through a selective solid absorbent contained in the innermost cylinder. The percentage of gas removed is determined from the reduction of pressure in the cylinder indicated by a gauge.

C. E. Hummel

Barthauer, G. L., Haggerty, A. and Friedrich, R. J. ANALYSIS OF SYNTHESIS GAS. *Anal. Chem.*, 25, 256-259 (1953) February.

A method has been developed for determination of CO_2, H_2, CO, and CH_4 in synthesis gas, based on gravimetric determinations of CO_2 before combustion, and CO_2 and H_20 after combustion with O_2 over platinized silica gel. No other determination is necessary in the absence of other components; when traces of oxygen or nitrogen are present, methane is determined by infrared absorption. Standard deviations for each of the several components, obtained from tests on synthetic mixtures, ranged from 0.13 to 0.21% on total sample. D. M. Mason

Hydrocarbon Calorimetry

Fein, R. S., Wilson, H. I. and Sherman, J. NET HEAT OF COMBUSTION OF PETROLEUM HYDROCARBONS. *Ind. Eng. Chem.*, 45, 610-4 (1953) March.

Empirical equations are presented for predicting the net heating value of aviation fuels and miscellaneous petroleum fractions from the aniline-gravity constant or from the characterization factor and gravity. The equations are based on data from 158 petroleum fractions and 117 individual hydrocarbons. Overall root-mean-square deviations of the predicted heats of combustion from the measured values are 103 and 131 Btu/lb. respectively. Deviations are attributed to differences in chemical composition not accounted for by the variables and to differences in both the precision and accuracy of measured values of the heats of combustion from different laboratories. D. J. Dennison

Infrared Spectra

Hales, J. L. AN OPTICAL SYSTEM AND THERMOPILE AMPLIFIER FOR DOUBLE-BEAM RECORDING OF INFRA-RED SPECTRA. *J. Sci. Instruments*, 30, 52-57 (1953) February.

A double-beam recording infrared spectrometer is described which utilizes a fast thermopile as a detector. The details of the associated amplifier system is presented, and the performance of the instrument is illustrated.

D. V. Kniebes

Spectrography

Shurkus, A. A. EMISSION SPECTROSCOPY IN INDUSTRIAL CONTROL. *Ind. Lab.*, 4, 8-12 (1953) February.

The use of the emission spectrograph for rapid analysis of industrial products is discussed.

D. V. Kniebes

Sulfur Determination

Belcher, R., Kapel, M. and Nutten, A. J. 4:4'-DIAMINOTOLANE AS A REAGENT FOR THE TITRIMETRIC DETERMINATION OF SULPHATE. *Analytica Chimica Acta*, 8, 146-149 (1953) February.

This reagent is used for the determination of quantities of sulfate greater than 10 mg., with an error of less than 1%. The analysis consists of the precipitation and recovery of amine sulfate and its titration with standard sodium hydroxide solution. Interfering ions are discussed. C. E. Hummel

Radmacher, W. and Mohrhaeuser, P. DIE INDIREKTE TITRIMETRISCHE SULFATBESTIMMUNG UND IHRE ANWENDUNG IN DER BRENNSTOFFANALYTIK. (THE INDIRECT TITRIMETRIC SULFATE DETERMINATION AND ITS APPLICATION IN FUEL ANALYSES). *Brennstoff-Chemie* (German), 34, 33-37 (1953) February 18.

A modification of the chromate method for determination of sulfate ion is described (precipitation of barium sulfate and barium chromate from barium chromate solution followed by determination of chromate ion in the filtrate) and its application to determination of total sulfur, bomb sulfur, pyrite and soluble sulfate sulfur is discussed. D. M. Mason

Synthetics Analysis

Weitkamp, A. W., Seelig, H. S., Bowman, N. J., and Cady, W. E. PRODUCTS OF THE HYDROGENATION OF CARBON MONOXIDE OVER AN IRON CATALYST ALIPHATIC AND ALICYCLIC HYDROCARBONS. *Ind. Eng. Chem.*, 45, 343-349 (1953) February.

The product consists of hydrocarbons and oxygenated compounds of a broad molecular weight range. In the present work, the hydrocarbons were analyzed by distillation, chromatography, spectrometric methods, and other means. The weight per cent yield reaches a maximum at three carbons and then declines almost exponentially with increasing carbon number. The branched isomers and the alicyclic hydrocarbons occur in increasing proportions in higher carbon-number fractions. Relationships among the structures and distributions of the open-chain and ring compounds reflect the mechanism of formation. Significant deviations from thermodynamic equilibria indicate that competing reaction rates control the product composition. Knowledge of the composition not only aids in the efficient utilization of the product but also permits a better understanding of the process. Since these papers are concerned with product composition, the apparatus and operating procedures used in the syntheses are briefly described. Appropriate analytical methods are mentioned incidentally with the analytical results, and new or special methods are discussed briefly as encountered. Authors' Abstract

Trace Elements

Leddicotte, G. W. and Reynolds, S. A. THE DETERMINATION OF TRACE ELEMENTS BY NEUTRON RADIOACTIVATION ANALYSIS. *Am. Soc. Testing Materials Bull.*, No. 188, 29-31 (1953) February.

Analysis of the induced radiation characteristics of a sample after exposure to intense external neutron radiation allows the determination of trace amounts of impurities. The methods and applications of neutron activation analysis is discussed. D V. Kniebes

8. GENERAL AND PHYSICAL CHEMISTRY

Acetylene-Nitrogen Reaction

Versteeg, J. and Winkler, C. A. THE REACTION OF ACTIVE NITROGEN WITH ACETYLENE. *Canadian J. Chem.*, 31, 129-133 (1953) February.

Active nitrogen produced by electrical discharge through gaseous nitrogen reacts with acetylene to produce mainly hydrogen cyanide and a polymer containing approximately 32% nitrogen. Some cyanogen and methane were also formed. A reaction mechanism involving atomic nitrogen as the active form is described.

D. M. Mason

Catalysts

Young, J. G., Hartung, W. H. and Daniels, H. H. PALLADIUM CATALYSIS. VI. THE REPRODUCIBILITY OF PALLADIUM-ON-CHARCOAL CATALYSTS. *J. Organic Chem.*, 18, 229-234 (1953) February.

Divided and duplicate catalysts were employed in the study of the reproducibility of palladium or charcoal catalysts. The results obtained with typical inhibitors (benzaldehyde, nitrobenzene, quinone and piperonal oxine) are described and the data are given graphically. The results of this study show considerable variation in the activity of catalysts presumably identical and tested under identical conditions.

H. A. Dirksen

Ethylene Adsorption

Stitt, F. and Tomimatsu, Y. REMOVAL AND RECOVERY OF TRACES OF ETHYLENE IN AIR BY SILICA GEL. *Anal. Chem.*, 25 181-3 (1953) January.

Adsorption on silica gel of ethylene in oxygen at concentrations of .003 to .08 p.p.m. in ethylene is complete within an experimental error of 10%. All of it is recovered at desorption temperatures of 300° C. Discrepancies between the data for ethylene on silica gels is explained by differences in the silca gels or nonlinearity of the isotherms at low partial pressures of ethylene. Adsorption of trace amounts of many gases and vapors should be feasible.

D. J. Dennison

Ethane Properties

Hamann, S. D. and McManamey, W. J. THE SECOND VIRIAL COEFFICIENT OF ETHANE. *Trans. Faraday Soc.* (British), **49**, 149-2 (1953) February.

The second virial coefficient of ethane has been measured by a comparative method (described previously *Trans. Faraday Soc.* 48, 101 (1952) at low pressures (0.5-2.0 atm.) between 30° C. and 150° C. The results show ethane to obey the principle of corresponding states and confirm the results of Reamer, Olds, Sage and Lacey. I. P. Patel

Flame Temperatures

Broida, H. P. ROTATIONAL AND VIBRATIONAL "TEMPERATURES" OF *CH* IN FLAMES AT ATMOSPHERIC PRESSURE. *J. Chem. Physics*, **21**, 340-346 (1953) February.

Excited CH is formed by a non-thermal process and althought the distributions are close to thermal, it is unreliable as a temperature indicator. A. R. Khan

High Pressure Technique

Bridgman, P. W. HIGH-PRESSURE INSTRUMENTATION. *Mech. Eng.*, **75**, 111-13 (1953) February.

An easily read and informative paper which enumerates some of the old high pressure fallacies and some of the experimental difficulties. The broad area still unexplored is discussed with reference to the phenomena probably occurring at pressures approximately 100,000 atm. The remainder of the paper concerns the special instrumentation techniques.

W. W. Clauson

Interaction Coefficients

Gorski, R. A. and Miller, J. G. THE INTERACTION COEFFICIENTS OF GAS MIXTURES. *J. Am. Chem. Soc.*, **75**, 550-552 (1953) February 5.

The method of Edwards and Roseveare has been used to study the interaction coefficients of the following gaseous mixtures at 30°: CO_2-N_2, O_2-N_2, CO_2-O_2. An apparatus of improved design is described for making the measurements. The results give proof that the method is satisfactory for evaluation of the quantity $2B_{12} - (B_{11} + B_{22})$, where B_{12} is the interaction coefficient and B_{11} and B_{22} are the individual second virial coefficients of the constituents of the mixture. Values of the interaction coefficients determined in this way for the CO_2-N_2 and O_2-N_2 systems agree satisfactorily with theoretical values based on simple combination rules for the force constants involved. The CO_2-O_2, results show a disagreement with the theoretical values which may be due to these combination rules.

Authors' Abstract

Liquid Interfaces

Buchanan, R. H. DROP FORMATION IN LIQUID-LIQUID SYSTEMS WHEN THE ORIFICE IS WET BY THE DISPERSED PHASE. *Australian J. Appl. Sci.*, **3**, 233-6 (1952) September.

A qualitative description is given for the difference in drop formation by wetted and non-wetted orifice materials. It is observed that, at low orifice velocities, a wetted orifice will give drops larger than those formed by one of the same size but not wetted preferentially by the dispersing phase. This difference is explained in terms of the magnitude of the adhesive forces involved in the two cases. As the orifice velocity increases, the drop size decreases and the difference between the two types of orifice also decreases until a high orifice velocity, say 25 cm/sec, is reached, when the dispersed phase shoots out in the form of a spray and the difference between the orifices disappears completely. Drawings illustrate the difference in drop size at equal orifice velocities and in the mechanism of drop formation between a wetted and non-wetted orifice. Experiments on the dispersion of kerosene into water with a polythene orifice, which is wetted by the kerosene phase, are described. S. Hu

Propane-H_2S Equilibria

Kay, W. B. and Rambosek, G. M. LIQUID-VAPOR EQUILIBRIUM RELATIONS IN BINARY SYSTEMS. PROPANE-HYDROGEN SULFIDE SYSTEM. *Ind. Eng. Chem.*, 45, 221-226 (1953) January.

P-T border curves and the saturated liquid and vapor densities were determined on seven mix-

tures of varying composition. The system has a minimum critical temperature at a composition of 39.5 mole % propane, at 184° F. and 910 psi pressure. A minimum boiling azeotrope is formed and persists up to the critical region. Its composition is 20.25 mole % propane at 200 psi, and decreases to 5.7 mole % at 1200 psi. Separation of any mixture into its pure components by distillation is impossible.

D. M. Mason

Propane-Water Equilibria

Kobayashi, R. and Katz, D. L. VAPOR-LIQUID EQUILIBRIA FOR BINARY HYDROCARBON-WATER SYSTEMS. *Ind. Eng. Chem.*, 45, 440-6 (1953) February.

Results are presented of an experimental investigation of the phase behavior of the propane-water system. The range of temperature was 60 to 300° F. and pressure 100 to 2800 psia. Correlations are presented for predicting the saturated water content of hydrocarbon fluid phases and the solubitity of water in the hydrocarbons over a wide range of conditions. Molal volumes rather than pressure has been used to correlate the saturated water content of vapor- and liquid-hydrocarbon-rich phases in the same correlation.

O. T. Bloomer

Surface Chemistry

Gomer, R. FIELD EMISSION FROM NICKEL SURFACES. *J. Chem. Physics*, 21, 293-303 (1953) February.

An account of field emission experiments on clean and contaminated nickel surfaces is presented. It is concluded that the equilibrium shapes of Ni single crystals are close to spheroidal with flat regions at low index directions. Evidence for the formation of surface phases of carbon, silicon, and oxygen on Ni is presented. A method for studying the diffusion of Si in Ni is described. Chemisorption of O_2 on Ni is briefly described. A method for studying grain boundary migration is given.

Author's Abstract

Thermal Conductivity

Vines, R. G. THE THERMAL CONDUCTIVITY OF ORGANIC VAPOURS: THE INFLUENCE OF MOLECULAR INTERACTION. *Australian J. Chem.*, 6, 1-26 (1953) February.

The thermal conductivity of a large number of simple organic vapors has been determined at various pressures and temperatures. The variation of thermal conductivity with pressure has been attributed to accumulation effects or the non-ideal properties of the gases. This variation of conductivity with pressure was the greatest for polar materials, and it was correlated with charges in specific heat.

R. E. Peck

Thermal Diffusion

Hirota, K. and Kobayashi, Y. ON DRICKAMER'S MODIFICATION OF THE THEORY OF THE THERMAL DIFFUSION COLUMN. *J. Chem. Physics*, 21, 246-9 (1953) February.

By use of thermal diffusion columns, the N_2-H_2 system has been separated continuously and its thermal diffusion ratio α has been determined with a method of least ambiguity under a pressure range of 1-12.6 atmos. The α-values thus obtained, based on the Furry-Jones theory of the apparatus, have been found to be not constant and also to differ very much in most cases from those hitherto reported. However, the values corrected according to the theory modified by Drickamer et al. have been shown to be reasonable, supporting their modified theory.

Authors' Abstract

Vapor Pressure

Frost, A. A. and Kalkwarf, D. R. A SEMI-EMPIRICAL EQUATION FOR THE VAPOR PRESSURE OF LIQUIDS AS A FUNCTION OF TEMPERATURE. *J. Chem. Physics*, 21, 264-267 (1953) February.

The slight reverse curvature in the plot of log P versus 1/T (P, vapor pressure; T, absolute temperature) may be explained on the basis of the nonideal behavior of the vapor together with the change in heat of vaporization with temperature. If it is assumed that $\triangle$ H is linear with T and that the van der Waals a/V^2 term is a first approximation to the deviation from the ideal, the following equation may be obtained by integration of the Clapeyron equation:

$$\log P = A + B/T + C \log T + D P/T^2.$$

The last term is the nonideal gas correction with constant $D = a/2.303R^2$. With constants A, B, and C determined empirically, the equation reproduces experimental vapor pressures from the triple point to the critical point with an average deviation of 0.3 percent.

Authors' Abstract

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Hales, J. L. OPTICAL SYSTEM FOR INFRARED SPECTROMETER, p. 88

Hunt, B. E. REACTIONS OF CARBON WITH STEAM. p. 81

9. ORGANIC CHEMISTRY

Acetylene Process

Bogart, M. J., Schiller, G. R. and Coberly, C. J. THE WULFF PROCESS FOR ACETYLENE FROM HYDROCARBONS. *Petroleum Proc.*, 8, 377-382 (1953) March.

The Wulff process for acetylene production from hydrocarbons is described. Particular attention is given to the design of the Wulff regenerative furnace, flow of materials through the pyrolysis and recovery sections, and the economics of the process. In view of the growing demand for acetylene as an intermediate in the production of many synthetic materials, the Wulff process presents a favorable economic picture when using natural gas or propane as a raw material. J. M. Reid

CS_2 Synthesis

Cevidalli, G. CONTRIBUTO ALLA CONOSCENZA DELLA SINTESI DEL SOLFURO DI CARBONIA DA METANO E ZOLFO. (CONTRIBUTION TO THE KNOWLEDGE OF THE SYNTHESIS OF CARBON DISULFIDE FROM METHANE AND SULFUR). *Rivista Combustibili* (Italian), 7, 5-12 (1953) January.

After a short review of the thermo-dynamical problems connected with the synthesis of carbon disulfide from methane and sulfur, the apparatus used for the study of different catalysts is described. The sulfur feeder is particularly dealt with. With some of the catalysts examined, sulfur conversions of 90% have been obtained, with yields of carbon disulfide quantitative in respect to the reaction $CH_4 + 2\ S_2 = CS_2 + 2\ H_2S$. Author's Abstract

Ethylene Process

ETHYLENE. *Chem. Eng.*, 60, 272-5 (1953) March.

A flow sheet description of the Lummus' process for ethylene by thermal cracking of ethane and propane. The recovery system features oil absorption followed by low-temperature fractionation. W. G. Bair

Paraffin Isomerization

Ciapetta, F. G. and Hunter, J. B. ISOMERIZATION OF SATURATED HYDROCARBONS IN PRESENCE OF HYDROGENATION-CRACKING CATALYSTS: NORMAL HEXANE. *Ind. Eng. Chem.*, 45, 147-55 (1953) January.

An extensive study was made of the isomerization of n-hexane with mixed catalysts containing a hydrogenation agent and a cracking agent. The mixed catalyst for most of the work was a nickel-silica-alumina mixture, but the work was extended to include silica-alumina in combination with other hydrogenating agents. A discussion of the effect of operating variables is included. G. V. Vosseller

Ciapetta, F. G. NATURE OF THE CATALYST AND MECHANISM OF THE REACTION. *Ind. Eng. Chem.*, 45, 162-5 (1953) January.

The effect of sodium ions in relation to the chemical nature of the isomerization catalyst and the mechanism of the reaction has been investigated, and the results are presented in tabular and graphical form. The results for two reactions (reaction of n-hexane in the presence of nickel-silica-alumina catalyst containing 1.24 weight % sodium and hydro-isomerization of 1-pentene and 1-hexane over standard nickel-silica-alumina catalyst in the presence of excess hydrogen) indicate that sodium ions poison the isomerization reaction by lowering the acidity

of the catalyst and that isomerization during the hyrogenation reaction occurs by carbonium ion mechanism. J. M. Reid

Petroleum Chemicals

Tracy, O. V. NAPHTHALENE AND NITROGEN. *Petroleum Proc.*, 8, 250-252 (1953) February.

The petroleum industry as a volume source of naphthalene, nitrogen compounds and benzene to supplement the supply of these materials from coal tar is discussed from an economic point of view. It is pointed out that two sources for the same chemical can establish two different market prices based on production cost, but these can be tolerated because of the insufficient supply of the products. J. M. Reid

Whalley, H. K. THE PETROLEUM-CHEMICALS INDUSTRY IN BRITAIN. PART II. *Coke and Gas* (British), 15, 61-63, 66 (1953) February.

The article gives an account of the development in Great Britain of the manufacture of petroleum chemicals, which results from the new policy of home refining. H. A. Dirksen

Oxo Chemicals

Sherwood, P. W. THE OXO PROCESS IN THE U. S. FOR PETROCHEMICALS FROM OLEFINS. *Petroleum Processing*, 8, 241-5 (1953) February.

A brief review of the production of petrochemicals from olefins via oxo-synthesis in the United States is presented. The limitations of the process, complexities of the products and effect of reaction conditions are discussed along with the various processes available for synthesis. The end uses of the various alcohols and aldehydes produced are given, but no production figures are presented.

G. V. Vosseller

Paraffin Separation

Arey, W. F., Jr. (assigned to Standard Oil Development Co.) SEGREGATION OF HYDROCARBONS WITH UREA AT LOW TEMPERATURES. U. S. 2,627,513 (1953) February 3.

Improvement of the urea extraction-crystallization process for segregation of normal aliphatic hydrocarbons from mixtures of other types of hydrocarbons by operation at or somewhat below a temperature of 40° F. is described. D. M. Mason

Tar Oils

Franck, H. G. DIE WAHRE NATUR DER TECHNISCHEN TEEROELE. (THE TRUE NATURE OF THE TECHNICAL TAR OILS. *Brennstoff-Chemie* (German) 34, 37-45 (1953) February 18.

Technical tar oils, comprising the impregnating, heating, fuel and wash oils, are described in considerable detail. Production, yields, properties and analytical methods for this general class are reviewed. Tabulated data are presented for freezing point of 60 binary mixtures of pure compounds which occur in these oils, and peculiarities of certain pairs are illustrated by curves. Since the pure compounds are chiefly high-melting solids, their liquid state depends upon a multiple eutectic effect and this is readily disturbed to produce undesirable "crystallized" sediments. Prevention of sediment by solvent or reagent additions can be practised to further the industrial uses of these coal products. O. P. Brysch

10. CHEMICAL ENGINEERING

Ejector Systems

Medici, M. THE DESIGN OF JET EJECTORS. *Eng. Digest* (British) 14, 51-9 (1953) February.

The design of steam jet ejectors for vacuum service is covered in detail. Several standard designs are illustrated. W. G. Bair

Fluidized Heat Transfer

Olin, H. L. and Dean, O. C. HEAT TRANSFER AND FOULING OF FLUIDIZED BEDS. *Petroleum Eng.*, 25, C23-C32 (1953) March.

Variation in heat transfer in beds of particles fluidized with air appears to be a direct function of particle motion and an inverse function of

voidage for a given solid. The effects of fouling on heat transfer appears to be proportional to the influence such fouling exerts on particle motion and voidage. A 4-in. steel pipe 30-in. long loaded with sand was used to secure the data. Graphs and tables of results are included.

G. Engholm

Fluidized Mass Transfer

Chu, J. C., Kalil, J. and Wetteroth, W. A. MASS TRANSFER IN A FLUIDIZED BED. *Chem. Eng. Progress*, **49**, 141-9 (1953) March.

Generalized correlations are presented for mass transfer and fluid friction for fixed and fluidized granular beds. The results are presented as equations and graphs of J_D and f as functions of the Reynolds number. The data indicates that J_D is approximately equal to f/10.

R. E. Peck

Fluidized SO_2 Production

SO_2 BY FLUIDIZATION. *Chem. Eng.*, **60**, 238-241 (1953) January.

Within a short time, eight different paper mills and four sulfuric acid manufacturers will be operating fluidized bed systems to supply major portions of their vital SO_2 from pyrite or pyrrhotite. A flow-sheet and brief description of the process is given here. D. M. Mason

Fog Filter

Thomas, F. A., Jr. EFFECTIVENESS OF THE FOG FILTER. *Heating Ventilating*, **50**, 113-115 (1953) February.

The fog filter is most effective on dust containing particles less than ten microns in diameter. Good performance has been indicated on certain fine dusts and fumes, some oils, mists, and odors. Power required is about 2 hp/MCF/min. The water requirement ranges from 5-10 gal/MCF air for a rate of 5000 cfm. Performance data for the fog filter on a number of industrial gases is included. E. J. Pyrcioch

Grinding

Erickson, H. W. TYPES OF GRINDING MILLS AND WHEN TO USE THEM. *Chem. Eng. Progress*, **49**, 63-68 (1953) February.

The fundamentals of grinding operations are discussed, consideration being given to open and closed-circuit grinding, stage grinding, and wet and dry grinding. The construction, operation, and characteristics of a number of types of grinding mills most used in the chemical industry is given. Only a careful study of the grinding problem will indicate the most practical and economical grinding mill. Generally the energy required to reduce from a certain size to a given specification will be the same regardless of the type of mill used.

E. J. Pyrcioch

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Bridgman, P. W. HIGH-PRESSURE INSTRUMENTATION. p. 90

Procopi, J. GAS TRANSMISSION CONTROL PROBLEMS. p. 84

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Automatic Computors

Buchanan, A. C., Jr. and Skinner, H. ELECTRONICS SPEEDS GAS VOLUME CALCULATIONS. *World Oil*, **136**, 186-190 (1953) March.

Electronic machines are calculating, correcting, posting and summarizing gas volumes as measured by orifice meters. These high-speed computing machines are eliminating the monotony of mass calculations, speeding up accounting procedures and freeing specialized personnel for creative work. R. A. Brown

Stephenson, R. E., Eaton, J. R. and Duffy, F. L. SIMPLIFY ANALYZER ADAPTION. *Am. Gas Assoc. Monthly*, **35**, 27-31, 44 (1953) February.

An electric network analyzer and the determination of flow and pressure relations in complicated multipipe networks are described. This analyzer differs from others of its type in the use of a cathode ray oscilloscope as a visual indicator for adjusting circuit elements thereby eliminating intermediate readings and calculations. R. A. Brown

Coal & Ash Handling

Given, D. M. and Marshall, C. A. HANDLING COAL AND ASHES ECONOMICALLY IN SMALLER PLANTS. *Mech. Eng.*, 75, 125-129, 148 (1953) February.

The selection of the most economical coal and ash handling systems is discussed with regard to fixed charges and operating costs for plants burning less than 30,000 tons of coal annually.

E. J. Pyrcioch

Gas Meters

Attaway, D. PREVENTION OF FREEZING IN MEASURING AND REGULATING EQUIPMENT. *Petroleum Eng.*, 25, B90, 3, 5, 6 (1953) February.

Methods for prevention of freezing in gas meter installations are reviewed. Primary prevention would consist of an adequate drying process to remove as much water vapor as possible before the metering installations. Steam and electric heaters are also used to keep meter bodies, lines and valves above the freezing point in open installations.

W. G. Bair

High Pressure Pump

Hiteshue, R. W. and Clark, E. L. A SMALL HIGH-PRESSURE PUMP FOR PILOT-PLANT SERVICE. *Mech. Eng.*, 75, 205-206 (1953) March.

Design features are presented of a 10,000 psi pressure pump used in connection with coal hydrogenation work at the U. S. Bureau of Mines.

C. von Fredersdorff

Humidity Control

Wylie, R. G. and Harper, A. F. THE ACCURATE CONTROL OF RELATIVE HUMIDITY. *Australian J. Appl. Sci.*, 3, 219-227 (1952) September.

Psychrometer elements inside a closed cabinet determine the out-of-balance emf. that stabilizes the relative humidity (independent or dependent in a predetermined manner on the cabinet temperature) within $\pm$ 1%. Method and apparatus are described and illustrated.

A. J. Tulis

Magnetic Balance

Simons, J. H., Scheirer, C. L., Jr., and Ritter, H. L. MAGNETIC WEIGHING AND GAS-DENSITY BALANCES. *Rev. Sci. Instruments*, 24, 36-42 (1953) January.

A gas density balance is described which utilizes an electromagnetic device instead of weights or springs for weighing purposes. Using a capacitance null-point indicator this balance is sensitive to weight changes of 0.0000001 gram.

D. V. Kniebes

Piping Costs

Braca, R. M. and Happel, J. NEW COST DATA BRING ECONOMIC PIPE SIZING UP TO DATE. *Chem. Eng.*, 60, 180-187 (1953) January.

A method is presented for selecting the most economical liquid velocity and pipe size for process plant installation based on initial installation costs, operating and maintenance costs and pump efficiencies.

E. J. Pyrcioch

12. MATERIALS OF CONSTRUCTION

Coating Specifications

Shideler, N. T. DEVELOPING SPECIFICATIONS FOR COAL-TAR PIPELINE COATING. *Gas*, 29, 99, 100, 4, 8, 10 (1953) February.

Protective coatings are purchased by name instead of specifications, and manufacturers therefore have not attempted to fit the coatings to individual requirements. Various new test procedures for shear stress and pressure stress are evaluated. The effect of variations in the softening-point, mineral content, and penetration on the protective quality of the coatings are emphasized. The present need is for industry-wide specifications and testing procedures.

B. E. Eakin

Corrosion Control

Peabody, A. W. ECONOMICS OF CORROSION CONTROL. *Pipe Line News*, 25, 44-47 (1953) February.

A review of corrosion problems and their solutions in the distribution systems, mains, services, above-ground installations, production and transmission of natural gas. Emphasis is placed

on the fact that the most economical time to design a corrosion-free system is in the planning stage, not in replacements. However, as present equipment wears out, it should be replaced with corrosion resistance in mind.

B. E. Eakin

Flotation Painting

Donovan, L. B. FLOTATION PAINTING GAS HOLDERS AT 69,000 SQUARE FEET AN HOUR. *Corrosion*, **9**, 1, 2 (1953) January; *Gas*, **29**, 42-43 (1953) February.

Consolidated Edison Co. of New York has developed a flotation painting process for lifts of water-seal gas holders. A specially formulated paint is pumped on to the cupping water-surface when the lift is completely raised. As the lift is allowed to descend the paint adheres to the lift in an even, uniformly thick film. The lift is then raised and surplus paint is disengaged from the lift and forms a layer on top of the water seal. This layer can be pumped off and re-used. Greatly lowered labor costs and better coverage are claimed. W. G. Bair

High Temperature Steels

Braca, R. M. and Merims, R. HIGH TEMPERATURE SERVICE. *Chem. Eng.*, **60**, 165-171 (1953) February.

This is a comprehensive survey of steel for high-temperature processes based on metallurgical considerations and strength-cost emphasis resulting from present shortages of molybdenum, nickel, and columbium. Stress data and equipment design at elevated temperatures are discussed. A. J. Tulis

Inhibitors

Farrer, T. W., Biek, L., and Wormwell, F. THE ROLE OF TANNATES AND PHOSPHATES IN THE PRESERVATION OF ANCIENT BURIED IRON OBJECTS. *J. Appl. Chem.* (British), **3**, 80-84 (1953) February.

Ancient buried iron objects were found to be well preserved under conditions that would normally be highly corrosive. Evidence of the prevention of microbiological corrosion by tannates in the soil is presented. Phosphates also present contributed to the protective properties of the soil. P. P. Leo

Pipe Fabrication

Hoppe, W. C. LARGE-DIAMETER LINE PIPE. *Mech. Eng.*, **75**, 114-116 (1953) February.

The high-speed fabrication and testing of the A. O. Smith Corp. high-strength line pipe for gas transmission is described.

D. C. Gami

Pipe Line Corrosion

Deuber, C. G. BACTERIAL ATTACK ON BURIED PIPING REGARDED AS SERIOUS CAUSE OF RAPID CORROSION. *Am. Gas J.*, **178**, 31, 35 (1953) February; 23, 40 (1953) March: *Corrosion*, **9**, 95-99 (1953) March.

Ferrous metal pipe systems in certain poorly drained soils containing a certain bacteria suffer corrosive deterioration by bacterial action. These bacteria reduce sulfates to sulfides. Bacterial corrosion can be said to be a microbiological electrochemical mechanism of corrosion. As yet there is no effective means of protecting soil-buried iron fixtures from bacterial corrosion. Although these bacteria and soils are widely distributed, chief interest in this subject has been centered in the Eastern states.

G. Engholm

Refractories

Osborn, E. F. GEOCHEMISTRY AND REFRACTORIES. *Ind. Heating*, **20**, 330, 2, 4, 6, 8, 40 (1953) February.

The influence of basic geophysical and geochemical research on the development of improved steel-plant refractories is traced. The application of the basic information in selecting and testing stee! mill refractories is outlined.

E. J. Pyrcioch

Structural Plastics

LUCOFLEX SOLUTION TO CORROSION IN CHEMICAL PLANTS. *Can. Chem. Proc.*, **37**, 62-5 (1953) February.

Corrosion problems are being solved by using a high molecular weight, hard polyvinyl chloride plastic called *Lucoflex* in exhaust systems and in the fabrication of self-supporting tanks and tank liners. Comparative costs, chemical properties and available forms of this material are presented. The installation and successful use of *Lucoflex* in three different manufacturing companies is described. D. J. Dennison

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